

NEW GENERA OF NOTHOCHRYSINAE FROM SOUTH AMERICA (NEUROPTERA: CHRYSOPIDAE)

PHILLIP A. ADAMS¹ AND NORMAN D. PENNY²

¹Department of Biological Science, California State University,
Fullerton, California 92634

²California Academy of Sciences, Golden Gate Park,
San Francisco, California 94118

Abstract. — *Hypochrysa viridula* Adams (SE Brazil) is the type of *Asthenochrysa* Adams & Penny, NEW GENUS. *Leptochrysa prisca*, Adams & Penny, NEW GENUS, NEW SPECIES (Peru) has microtrichia over the entire wing membrane, and extraordinarily narrow wings with rectangular gradate cells.

Key Words. — Insecta, Neuroptera, Chrysopidae, Nothochrysinæ

This paper is Part 11b of the “Neuroptera of the Amazon Basin.” We have dealt with Chrysopini (Adams & Penny, 1987); other parts are in preparation. Fossils of Nothochrysinæ (= Dictyochrysinæ) are known from the Miocene and Oligocene of the western United States, and mid-Tertiary of Denmark, France and Germany (Adams 1967, Séméria 1990). Members of this subfamily are united by several plesiomorphies: jugum and frenulum present, lack of alar tympanal organ, presence of archaic pseudomeida (usually strongly zig-zagged without overlap of branches of radial sector [except in *Nothochrysa californica* Banks and *Dyspetochrysa*]), a little-sclerotized prosternum. The only possibly synapomorphic character more or less definitive for this subfamily is the presence of five or six setal whorls on each flagellomere (Brooks & Barnard 1990). This character state is shared only by the APOCHRYSINI; all other extant chrysopids have four whorls. We consider it highly probable that the Nothochrysinæ are paraphyletic.

The seven previously known extant genera of Nothochrysinæ were reviewed by Brooks & Barnard (1990). The few surviving members of this subfamily exhibit largely disjunct, apparently relictual, distributions. *Dictyochrysa* (3 species) and *Triplochrysa* (1 species) are Australian, *Kimochrysa* (3 species) and *Pamochrysa* (1 species) are South African. *Nothochrysa* (3 species) is found in western Europe and Pacific coastal states of the United States and Canada; *Pimachrysa* (5 species) occurs in California, Arizona and northwestern Mexico. *Hypochrysa* has 1 species in southern Europe.

In 1978, Adams described the first South American nothochrysinæ, *Hypochrysa viridula* Adams, from a single female specimen collected in northern Argentina. Since then, three additional specimens have come to light, all from Brazil. The presence among these of a male enables us to reconsider the generic affinities of this species. Also described here is a striking single female nothochrysinæ collected from the eastern slope of the Peruvian Andes, which is attributed to a new genus and species.

Biology. — Little is known of the biology of most nothochrysinæ species. Adults of *Pimachrysa* principally have been collected from November through April,

more frequently at molasses traps, along water flumes, and by sweeping, than by attraction to light. Seasonality of adult activity in some nothochrysinines may be correlated with availability of preferred pollen sources. *Nothochrysa californica* individuals do not mate until after feeding on oak pollen (Toschi 1965). Tjeder (1966) found large amounts of Asteraceae pollen in the "colon" of *Pamochrysa stellata* Tjeder, and Adams (1967) identified the pollen in the digestive tract of *Pimachrysa intermedia* Adams as that of willow (*Salix*). Pollen was present in the guts of both genera described here. (In chrysopid abdomens that have been treated with potassium hydroxide, pollen grains, if present, are ordinarily found in both the foregut diverticulum and the hindgut.) Because Nothochrysininae lack the alar tympanal organ found in the more successful subfamily Chrysopinae, they may be more subject to nocturnal predation by bats (Miller & MacLeod 1966). Dispersion and oviposition commonly take place at night in most chrysopine species (Duelli 1984). High mortality of adults in flight might in part explain the paucity of living nothochrysinine species.

Abbreviations.—Specimen depositories are represented as: CAS, California Academy of Science; NMNH, U. S. National Museum of Natural History; FSCA, Florida State Collection of Arthropods; MZSP, Museo de Zoología, Universidade de São Paulo.

ASTHENOCHRYSA ADAMS & PENNY, NEW GENUS

Figures 1–9

Type Species.—*Hypochrysa viridula* Adams (1978). Holotype female: ARGENTINA. *MISSIONES*: Iguazu, 4–10 Oct 1927, R. C. and E. M. Shannon (NMNH); deposited U. S. National Museum of Natural History, Washington, D.C.

Description.—Flagellar segments slender (length $2.4 \times$ width), five setal rows. Palpi slender, acute. Venation (Adams 1978: fig. 1) much as in *Hypochrysa*; forewing subcostal crossvein opposite basal third of cell M2; veins on sides of gradate cells nearly straight, not strongly undulating as in *Hypochrysa*; 2A and 3A approximated, connected by short crossvein, but terminating separately on wing margin (Fig. 8); microtrichia present over much of anal area. Hindwing subcosta and R not fused in middle. Tarsal claw with wide basal expansion and deep notch (Fig. 9). Body only lightly sclerotized, so that cuticle of pronotum and abdomen is shriveled and wrinkled in dried material.

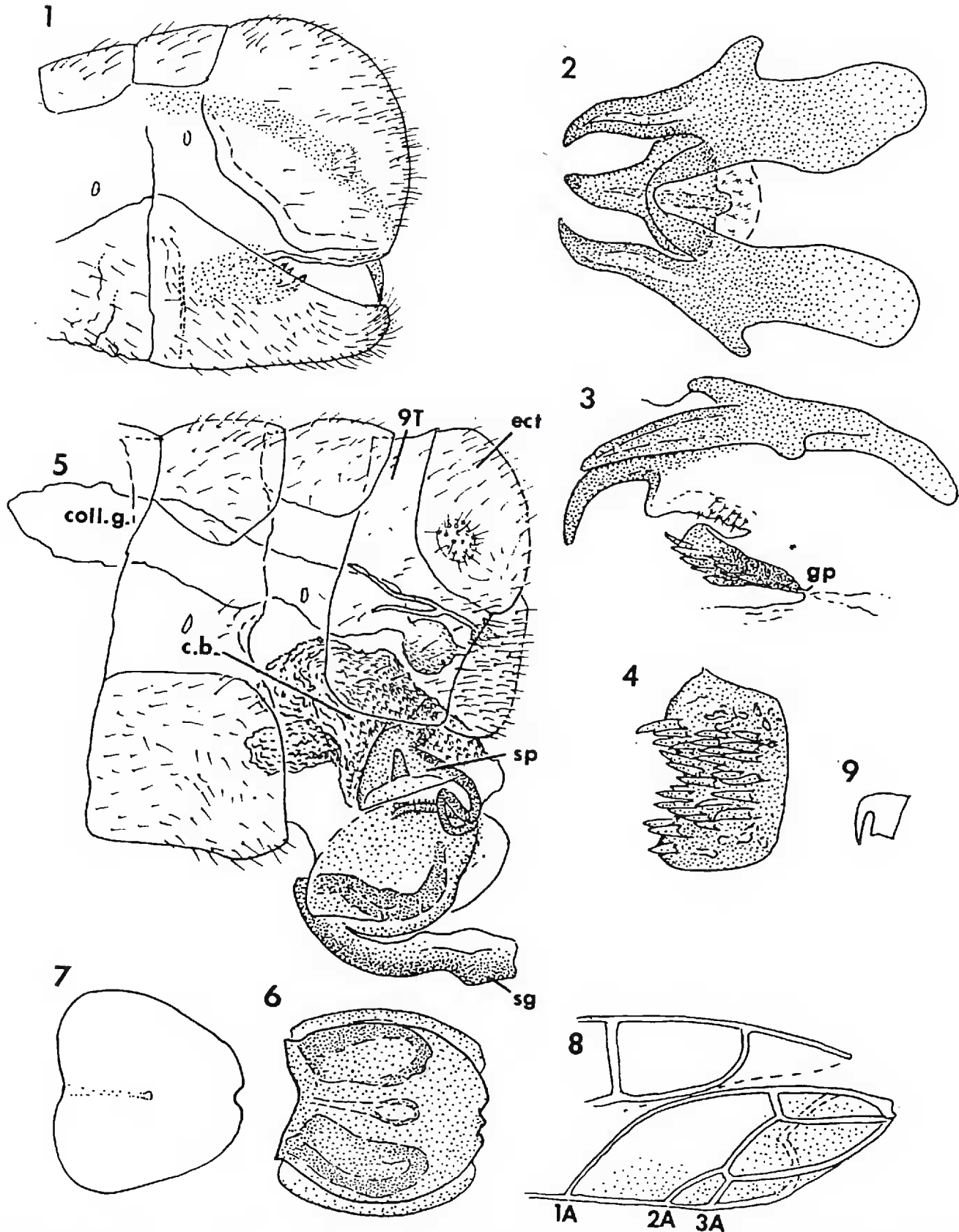
Male.—Genitalia massive; sternites eight and nine fused, suture vestigial; apex of ectoproct + 9T rounded (Fig. 1); microtholi absent. Gonarcus apodemes narrow, flattened dorsoventrally, continued posteriorly as sharp horns, bridge slender, upcurved; arcessus pointed and down-curved apically, broad basally (Fig. 2); gonosetae sparse, small; a heavily sclerotized plate bearing appressed, posteriorly directed spines lies between the gonosaccus and genital pore (Figs. 3 and 4).

Female.—Ninth tergite and ectoproct with weak demarcation suture; eighth abdominal spiracle on membrane; subgenitale a large flap hinged to massive secondary sclerites, the whole loosely attached and eversible (Fig. 5); spermatheca conical, bottom concave with slender ventral impression; duct short; bursa bearing triangular cristae internally, grading to smooth-walled anterolateral sacs (bursal glands?); colleterial gland sac smooth-walled; accessory gland slender, Y-shaped.

Diagnosis.—*Asthenochrysa* can be distinguished from other Nothochrysininae by the spinose plate between arcessus and gonopore in the male, the elaborate subgenitale in the female, and the lack of fusion of second and third anal veins of the forewing. It is the only small green nothochrysinine in South America.

Etymology.—From the Greek *astheno*—weak, referring to the relatively lightly sclerotized thoracic cuticle, and to the fragility of the wings + *chrysa*.

Discussion.—*Hypochrysa*, *Kimochrysa*, and *Asthenochrysa* all have rather sim-



Figures 1-9. *Asthenochrysa viridula* (Adams). Figure 1. Male abdominal apex, lateral. Figure 2. Gonarcus-mediuncus complex, dorsal. Figure 3. Same, lateral, showing gonosaccal plate dorsal to genital pore. Figure 4. Gonosaccal plate, ventral. Figure 5. Female abdominal apex, lateral, showing everted subgenitale and internal structures (Espiritu Santo). Figure 6. Same, subgenitale, ventral. Figure 7. Subgenitale, ventral (Minas Gerais). Figure 8. Anal area of left forewing; microtrichia shown by stipple; jugal lobe folded under. Figure 9. Mesothoracic pretarsal claw. Abbreviations: c.b.—copulatory bursa; coll.g.—colleterial gland; ect—ectoproct; gp—gonopore; sg—subgenitale; sp—spermatheca; 1A, 2A, 3A—anal veins; 9T—ninth tergite.

ilar wing venation. The basal position of the subcostal crossvein, and the crossvein connecting 2A and 3A lying near the wing margin, are distinctive. Given the highly disjunct distributions of these relict genera, it is not surprising that their genitalia exhibit striking differences. Externally, in male *Hypochochrysa*, the eighth

and ninth sternites are either separate (Adams 1967) or fused (Aspöck et al. 1980), and the ninth tergite and ectoproct are fused. In *Kimochrysa* these sternites are fused, but the ninth tergite and ectoproct are separate. In *Asthenochrysa*, both tergites and sternites are fused. The spinose plate between the mediuncus and gonopore is unique to *Asthenochrysa*, and this genus lacks the paddle-shaped entoprocessus of *Kimochrysa raphidioides* Tjeder and *K. impar* Tjeder, and the deeply bifid arcessus of *Hypochrysa*. In *Hypochrysa* and *Kimochrysa* females the subgenitale is normal-sized, not greatly enlarged as in *Asthenochrysa*.

There is some question as to whether the Brazilian and Argentinian material is conspecific. The subgenitale of the female from Minas Gerais is pyriform (Fig. 7), rather like that of the type of *A. viridula* Adams, while in the female from Espiritu Santo this structure is oval (Fig. 6).

Material Examined.—BRAZIL. *ESPIRITU SANTO*: Linhares, Parque Sooretam, Oct 1962, M. Alvarenga leg., 1 male 1 female (FSCA). *MINAS GERAIS*: Serra de Caraça, 4 Dec 1978, 1 female, Exp. Mus. Zool. (MZSP).

LEPTOCHRYSA ADAMS & PENNY, NEW GENUS

Type Species.—*Leptochrysa prisca* Adams & Penny.

Description.—Flagellar segments slender (length $1.6 \times$ width), with five complete and a partial sixth setal whorls; eyes small (Fig. 11); palpi elongate, tapered, galea narrow with conspicuous papilla. Claw without basal expansion. Wings elongate, forewing length $4.3 \times$ width; entire membrane bearing microtrichia; gradate cells rectangular, not elongate-hexagonal; pseudomedia (Psm) with no contact between adjacent longitudinal undulating veins, its intervening crossveins all angled relative to longitudinals; basal subcostal crossvein opposite crossvein cu_1 ; MP2 touching CuA , diverging to intersect crossvein mp_3 , then recurving to fuse with CuA ; pseudocubitus well developed in both wings; second anal vein of forewing forked, posterior branch not reaching the margin; forewing with jugum, hindwing with frenulum. Hindwing with MP1 joined to $Rs+MA$ by crossvein.

Diagnosis.—This genus is immediately distinguishable from all other extant Nothochrysinæ by its uniquely narrow wings, rectangular gradate cells, and distinctive intramedian cell.

Etymology.—From Greek *lepto*—fine, slender, in reference to the wing shape + *chrysa*.

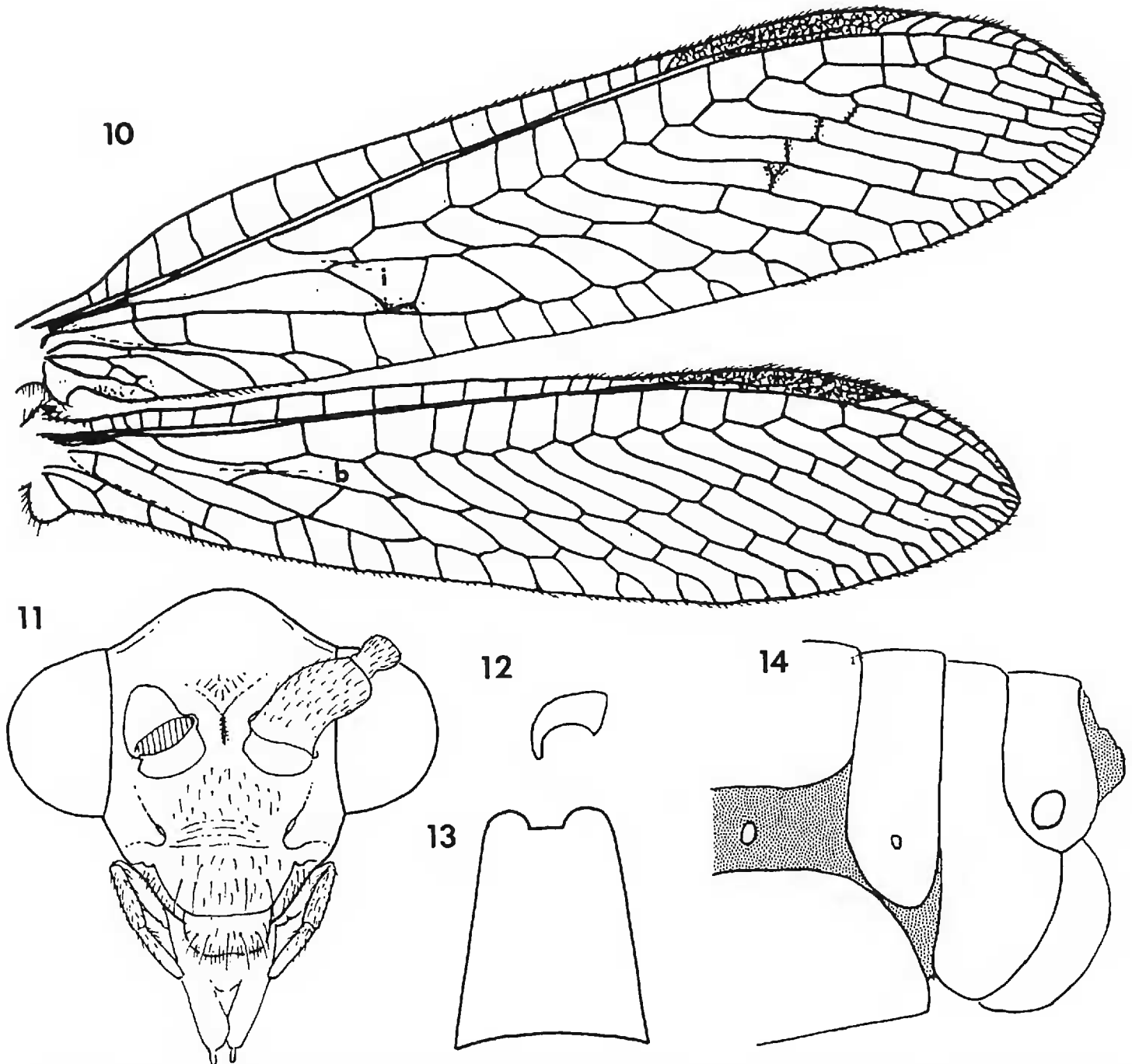
Material Examined.—*L. prisca* (see below).

Leptochrysa prisca Adams & Penny, NEW SPECIES

Figures 10–14

Type.—Unique holotype female, deposited: California Academy of Sciences. Label data: “PERU. *DEPT. AMAZONAS*: 18 km N of Puente Ingenio, km 320, alt 1750 m, 9 Oct 1964, P. C. Hutchinson & J. K. Wright, collected on *Baccharis latifolia* #6380.”

Description.—Head: frons, clypeus, gena, labrum, and vertex dark brown, without pale markings; maxillary and labial palpi dark brown; antennal scape about twice as long as broad, dark brown, curved laterally; more than 98 flagellomeres (apex broken off), basal 50 dark brown, apical segments pale brown. Pronotum short (width $0.85 \times$ length at margin), pale brown with lateral black line expanded anteriorly and posteriorly, triangular dark spot medially; setae short, pale. Meso- and meta-nota dark brown with sparse pale setae. Legs entirely dark brown, with short golden pilosity. Forewing (Fig. 10) length 20.0 mm, width 4.7 mm; all veins dark brown, bearing short, pale brown setae aligned



Figures 10–14. *Leptochrysa prisca*. Figure 10. Wings. Figure 11. Head. Figure 12. Metatarsal claw. Figure 13. Subgenitale. Figure 14. Female abdomen. Abbreviations: b—banksian cell, i—intramedian cell.

with vein in a single row; pterostigma elongate, pale yellow with dark brown reticulations; forewing first MP-Cu cell short, second cell elongate due to absence of second mp-cu crossvein; membrane dark at junction of MP2 with CuA and bordering several inner gradates; 12–13 inner, 9–10 outer gradates (difficult to delimit gradates because of assimilation of gradate series into Psm and Psc). Hindwing color as in forewing, but no veins dark-margined; unusually large flap in jugal region. Abdomen dark brown, setation golden, short; tergite eight extending ventrally below upper margin of sternite seven; bearing spiracle (Fig. 14); ectoprocts distinctly delimited from tergite nine; callus cerci near anteroventral margin; subgenitale (Fig. 13) elongate, sclerotization apparently extending to margin of sternite seven. Spermatheca not seen. Gut contents: pollen.

Diagnosis.—*Leptochrysa prisca* is the only species in the genus.

Discussion.—This specimen is heavily infested with black fungal mycelium, clinging to the cuticle, and filling the abdominal cavity, making it impossible to trace internal reproductive structures. Spiracles, borders of sclerites, and location of the trichobothria were extremely difficult to locate. The resulting general black coloration, together with the peculiar venational pattern and wing conformation, conspire to make it appear unlike a chrysopid. The mycelium follows the wing

vein cavities, and forms a meshwork, especially visible on the base of the left forewing. The similarity of this mesh to that in the stigmatic areas suggests that these latter areas are also infiltrated by the mycelium. If this were the case, however, one would not expect such precisely equivalent development of the mesh in each of the four stigmatic areas. The elongate wings resemble those of certain Mesozoic genera, such as *Aristenymphes* Panfilov (1980), which formerly was considered to be a mesochrysoptine, but now is thought to be more closely related to the Nymphidae (Martins-Neto, in litt.). The microtrichiose wing membrane is an archaic feature, typical of families such as Hemerobiidae, but restricted to the posterior forewing base in all other extant Chrysopidae. The configuration of the banksian cell of the hindwing (Fig. 10, "b") resembles that of the Miocene *Archaeochrysa* Adams (1967), but is not known to occur in other living chrysopids, in which MP contacts Rs+MA directly. The formation of the intramedian cell, wing elongation, and rectangular gradate cells are considered apomorphies.

ACKNOWLEDGMENT

Material has been made available through the kindness of Paul Arnaud (California Academy of Sciences), O. S. Flint (United States National Museum of Natural History), L. A. Stange (Florida State Collection of Arthropods) and N. Papavero (Museo de Zoología, Universidade de São Paulo). Their assistance is gratefully acknowledged.

LITERATURE CITED

- Adams, P. A. 1967. A review of the Mesochrysoptinae and Nothochrysoptinae (Neuroptera: Chrysopidae). *Bull. Mus. Comp. Zool., Harvard Univ.*, 135: 215–238.
- Adams, P. A. 1978. A new species of *Hypochrysa* and a new subgenus and species of *Mallada*. *Pan-Pacific Entomol.*, 54: 292–296.
- Aspöck, H., U. Aspöck & H. Hölzel. 1980. *Die Neuropteren Europas*. 2 vols. Geocke & Evers, Krefeld, Germany.
- Brooks, S. J. & P. C. Barnard. 1990. The green lacewings of the world: a generic review (Neuroptera: Chrysopidae). *Bull. Brit. Mus. Nat. Hist. (Entomol.)*, 59: 117–286.
- Duelli, P. 1984. Flight, dispersal, migration. pp. 110–116. *In* Canard, M., Y. Séméria & T. New (eds.). *Biology of Chrysopidae*. Series Entomologica 27. W. Junk, The Hague.
- Miller, L. A. & E. G. MacLeod. 1966. Ultrasonic sensitivity: a tympanal receptor in the green lacewing *Chrysopa carnea*. *Science*, 154: 891–893.
- Panfilov, D. V. 1980. New lacewing representatives (Neuroptera) from the Jurassic of Karatau. pp. 82–111, figs. 86–115, pls. 8–15. *In* Dolin, V. G., D. V. Panfilov, A. G. Ponomarenko & L. N. Pritikina (eds.). *Mesozoic fossil insects*. Naukova Dumka, Kiev. (In Russian.)
- Séméria, Y. 1990. *Paleochrysa monteilsensis* gen. et sp. nov., a new fossil of Chrysopidae from the Upper Eocene Formation of Monteils (France), with a review of the known chrysopid fossils (Insecta: Neuroptera). pp. 27–32. *In* Mansell, M. & H. Aspöck (eds.). *Proceedings of the Third International Symposium on Neuropterology, 1988*. Pretoria, R.S.A.
- Tjeder, B. 1966. Neuroptera—Planipennia. 5. Family Chrysopidae. *South African Animal Life*, 12: 228–534.
- Toschi, C. 1965. The taxonomy, life histories, and mating behavior of the green lacewings of Strawberry Canyon (Neuroptera: Chrysopidae). *Hilgardia* 36 (11): 391–433.

Received 19 September 1991; accepted 3 February 1992.